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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Jeffrey C. Dill

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EXAMINER

WANG, TED M

ART UNIT

PAPER NUMBER

2634

DATE MAILED: 11/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/835,727

Applicant(s)

DILL ET AL.

Examiner

Ted M Wang

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 25-32 is/are allowed.
- 6) ☒ Claim(s) 11, 18-21, 33, and 42-44 is/are rejected.
- 7) ☒ Claim(s) 1-10, 12-17, 22-24, 34-41 and 45 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 April 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/16/01, 4/22/04.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because
  - On Fig.22 (a) – 22(k), IIS matrix “IIS(x,x,x)” is not clear respectively.
  - Formal drawings for Fig.1 – Fig.34 are required.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. Figures 1-8 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

3. Claims 1-10 are objected to because of the following informalities:
  - On claim 1 limitation e) line 1, “each simplex” has not been defined properly, i.e. it could mean “simplex signal” or “simplex of channel symbols”, or “simplex-transition sets”.

- On claim 1 limitation f) line 2, "said simplex-transition of the STM" has not been defined properly.

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 11, 18, 19, and 33 are rejected under 35 U.S.C. 102(a) as being anticipated by the admitted prior art of the instant application.

- In regard claim 11, the admitted prior art of the instant application teaches a communication system with  
  
a circular trellis coded modulation (CTCM) encoder for converting a sequence of digital information bits of a predetermined length into a corresponding sequence of channel symbols (page 5 lines 9-33) based on a circular trellis path (page 5 lines 22-27) associated with the sequence of digital information bits (page 5 lines 22-26) and a set of simplexes identified for said path from a multi-dimensional signal constellation (page 8 lines 21 – 27 and page 9 lines 1-6), said CTCM encoder including means for determining an initial starting state of the trellis path

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which renders the path circular without the addition of redundant bits to the sequence of digital information bits (page 5 lines 21-33 and page 6 line 19 – page 7 line 2);

a transmitter coupled to said CTCM encoder for transmitting said sequence of channel symbols over said channel (Fig.1 elements 10, 14, 16, 20, and 30 and page 1 lines 15-25),

a receiver for receiving a transmission from said transmitter including said sequence of channel symbols and any noise induced therein (Fig.1 elements channel, 22, 24, 26, 34, and Information sink, and page 1 line 24 – page 2 line 4);

a CTCM decoder (page 9 lines 21-25) coupled to said receiver for decoding the received transmission without knowledge of the starting state of the circular trellis path of the CTCM encoder to recover the sequence of information bits (page 5 lines 21-33 and page 6 line 19 – page 7 line 2).

- In regard claim 18, the limitation that the determining means of the CTCM encoder includes means for calculating an initial starting state based on the sequence of digital information bits (page 5 lines 22-33 and page 6 lines 1-9).
- In regard claim 19, the limitation that the determining means of the CTCM encoder includes means for calculating an initial starting state by operating on the sequence of digital information bits with Zech's logarithm (page 6 lines 19-32).

- In regard claim 33, which is a method claim related to claim 11, all limitation is contained in claim 11. The explanation of all the limitation is already addressed in the above paragraph.
6. Claims 42-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Hladik et al. (US 5,721,746).
- In regard claim 42, Hladik et al. discloses a method of decoding a received sequence of channel symbols, denoted as  $Y_1^L = Y_1, Y_2, \dots, Y_L$  where  $L$  is the sequence length, from a channel to obtain a sequence of symbols  $X_1^L = X_1, X_2, \dots, X_L$ , belonging to the signal constellation of an encoder (column 3 lines 55 – 67 and column 4 lines 1-10), said method comprising the steps of:
    - hard decoding  $Y_t$  for each  $t$  of the sequence using the probability expression  $P(Y_t/X_t) = \max P(Y_t/X)$  (column 1 lines 10-60 and (column 4 lines 65 – column 5 line 15), for all  $X$ , i.e.  $X_1, X_2, \dots, X_L$ , where  $P(Y_t/X)$  is a function of the Euclidean distance between  $Y_t$  and  $X$  (column 4 lines 65 – column 5 line 15) and a noise spectrum density of the channel (column 1 lines 10-60 and Fig.6);
    - selecting  $Y_t$  having the largest  $P(Y_t/X)$  as  $Y_i$  (column 3 lines 18-column 5 line 60);
    - circular shifting the sequence  $Y_1^L$  using  $Y_i$  as the starting symbol; and
    - decoding the circular shifted sequence by an iterative circular BCJR algorithm to obtain a corresponding information symbol sequence (column 3 lines 18-column 5 line 60).
  - In regard claim 43, all limitation can further be taught in (column 3 lines 18-column 5 line 60).

- In regard claim 44, the limitation of including the step of selectively normalizing the sets of  $\alpha_t$  and  $\beta_t$ , for  $t = 1$  to  $L$  (column 6 lines 8-46), where  $L$  is the channel block length (column 3 lines 43-54).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art of the instant application in view of Hladik et al. (US 5,721,746).

- With regard claim 20, the admitted prior art of the instant application discloses all of the subject matter as described above except for specifically teaching that the CTCM decoder includes an iterative circular shift BCJR algorithm for decoding the received sequence of symbols.

However, Hladik et al. cited by the applicant teaches that the CTCM decoder includes an iterative circular shift BCJR algorithm for decoding the received sequence of symbols

(Fig.1, abstract, column 2 lines 14-32 and column 3 lines 1-43).

It is desirable to include an iterative circular shift BCJR algorithm for decoding the received sequence of symbols to reduce the complexities of the hardware and software (column 8 lines 27-36). Therefore, It would have been obvious to one of ordinary skill in the art at the time of the invention was made to include an iterative circular shift BCJR algorithm as taught by Hladik et al. into the admitted prior art of the instant application's decoder so as to reduce the complexities of the hardware and software.

- With regard claim 21, the admitted prior art of the instant application discloses all of the subject matter as described above except for specifically teaching that the CTCM decoder includes means for decoding the received sequence of symbols based on a statistical estimate of the starting state of the CTCM encoder. However, Hladik et al. cited by the applicant teaches that the CTCM decoder includes means for decoding the received sequence of symbols based on a statistical estimate of the starting state of the CTCM encoder (column 1 lines 62-67 and column 2 lines 1-32) so that the fading issue due to low-signal-to-noise power ratio is improved (column 11 lines 61-65).

It is desirable to decode the received sequence of symbols based on a statistical estimate of the starting state of the CTCM encoder in a decoder, since without it the speech quality in equipment operating over very noisy channel will be poor (column 11 lines 39-53). Therefore, It would have been obvious to one of ordinary skill in the art at the time of the invention was made to include the optimal soft-output decoder for a tail-biting encodes as taught by Hladik et al. into



the admitted prior art of the instant application's decoder so as to improve fading due to low-signal-to-noise power ratio.

***Allowable Subject Matter***

9. Claims 12-17, 22-24, 34-41, and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
10. Claims 1-10 would be allowable if rewritten to overcome the objection(s) set forth in this Office action.
11. Claims 25-32 are allowed.

***Conclusion***

12. Reference US 6,560,362 and US 6,578,173 are cited because they are put pertinent to the Trellis Coded Modulation. However, none of references teach detailed connection as recited in claim.
13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ted M Wang whose telephone number is (571) 272-3053. The examiner can normally be reached on 8:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571) 272-3056. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-0377.

Ted M Wang  
Examiner  
Art Unit 2634

Ted M. Wang

A handwritten signature in black ink, appearing to read "Shuwang Liu".

SHUWANG LIU  
PRIMARY EXAMINER